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Impact of varying degrees of floor perforation under the hind legs of sows in farrowing crates

Three different flooring treatments were evaluated for their impact on performance, health, behaviour and cleanliness of nursing sows with 472 litters: A = Perforation of < 10 %, B = Perforation of approx. 40 % within the entire crate, C = Combination of A and B. Reproductive performance, growth and losses of piglets were not influenced by the varying degrees of perforation. Treatment B resulted in more relaxed behavioural state and better stand of sows but also increased in tendency the risk for injuries on claws, udder and the integument. Treatment B had a positive effect on the incidence of injuries on the legs and teats of piglets. The low degree of perforation resulted in a significant increase in dirtiness of floor and animals.

Keywords
Farrowing crates, slatted floor, animal welfare, behaviour, cleanliness of pen

Abstract

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In intensive production systems sows are confined in farrowing crates during the entire birth and nursing period to protect piglets from crushing. The reduced space to move effects their physical integrity and the mortality rate of piglets [1]. In addition, characteristics of the floor material play an important role for the behaviour and well-being of pigs [2]. The floor under the sow in the confined farrowing crate has not only the function to drain faeces and urine but must also provide traction, resting comfort and prevent injury and loss of heat. The functionality of the floor depends especially on the used material and the degree of perforation. The aim of the study was to evaluate the effects of varying degrees of floor perforation under the sow on health, behaviour and performance.

Material and methods

The experiments were carried out on 472 litters in two research stations (Training and Research Farm Köllitsch and Centre for Livestock Science Merbitz). Crossbred sows (DE × DL) were used in Köllitsch and Hermitage sows in Merbitz. Three different types of floor perforation were evaluated in each research station:

- Type A = uniform perforation of < 10 % within the entire crate
- Type B = uniform perforation of approx. 40 % within the entire crate
- Type C = < 10 % perforation in the front part of the crate and 40 % perforartion in the rear part of the crate

Performance, health and behaviour were evaluated by weighing, video observation or body scores of sows (**table 1**) [3].

Normally distributed traits (live weights of sows and piglets, litter size, mortality rate) were analyzed by univariate variance procedure. A Tukey-Test ($p < 0.05$) was used for pair wise comparisons of floor types. Not normally distributed traits (body scores) were analyzed by Kruskal-Wallis-Test or Chi-Quadrat-Test. Mann-Whitney-U-Test and fitting of significance levels according to Bonferroni [4] were used for comparisons between floor types.

Results and discussion

The degree of perforation did not influence fertility, rearing performance and mortality rate of piglets. The claws of the sows were already in part severely injured at the beginning of the housing period in farrowing crates. These injuries resulted from earlier gestation housing in group pens. During lactation, a low degree of perforation (type A) had in tendency a positive influence on the healing process of old lesions or protects the claws from new injuries. However, this effect was only significant in a few cases. For example, broken claws and skin abrasions above the claws of the hind legs healed more frequently on a floor with 10 % of perforation in comparison to a floor with 40 % of perforation (type B). Length and growth rate of the claws were significantly lower on floors with 10 % perforation than on those with 40 %. However, sows sliped more often on a floor with 10 % of perforation.

Injuries of the teats were significantly influenced by the degree of perforation in only a few cases, although these abrasions were caused almost exclusively during the nursing period. 97.2 % of teats with surrounding udder tissue were intact at the beginning of the farrowing period (**figure 1**). Compared to type B, a perforation of 10 % resulted in fewer abrasions and to lower rate of teat tips losses on frequently used teats of the left body side (significant for data from Köllitsch).

While a low degree of perforation had positive effects on the integrity of sows, it caused more skin abrasions on carpal joints and teats on piglets that were housed in Köllitsch (**table 2**). This means that the floor under the sow is also intensively used by piglets. In accordance to results from the literature [5; 6], these injuries were especially evident during the first nursing week and the incidence was significantly lower in type B and C compared to type A.

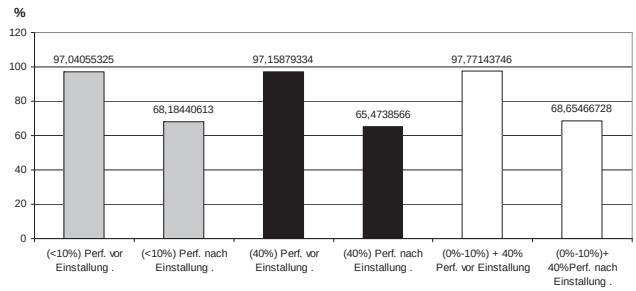
Sows in type B spent less time lying on their belly or in half-side recumbence and they changed not so frequently their body position than sows in type A, which indicates a more relaxed lying behaviour (**table 3**). The body position had also positive effetcs on the nursing behaviour: sows in type B nursed their piglets longer and more often than in type A and C. Sows in type A were sitting longer than sows in type B and/or C. However, this could not be explained as a consequence of more severe joint and claw injuries that may have prevented them from standing.

Table 1

Evaluation of performance, health, behaviour and cleanliness of sows

Trait	Time of assessment	
	Köllitsch	Merbitz
Sows		
Live weight	Begin and end of the nursing period	Begin and end of the nursing period
Fertility, rearing performance	From birth to weaning	From birth to weaning
Condition of claws	Begin and end of the nursing period	Begin of the nursing period and after weaning
Growth of claws	-	Begin of the nursing period and after weaning
Condition of joints	Begin and end of the nursing period	Just before the nursing period and after weaning
Condition of teats and integument	Four times during the nursing period	Just before the nursing period and after weaning
Behaviour	-	At birth, 1 day, 2 and 4 weeks after birth
Dirt level of sows and floors	Weekly	Begin and end of the nursing period
Piglets		
Live weight	At birth and at weaning	Four times between birth and weaning
Condition of claws	-	Approx. 11th and 26th day of age
Skin abrasions	Approx. 7th day of age and at weaning	Approx. 11th and 26th day of age

Fig. 1



Frequency of intact sow teats before and after housing in nursery pens

The low degree of perforation resulted in a significant increase in the dirtiness of pigs. Additionally, the floor under the hind legs of the sows in type A was dirtier than in the other types.

An increasing floor perforation tends to increase the negative effects on sow integrity but had positive effects on the integrity of piglets.

Table 2

Frequency of piglets without skin abrasions on carpal and tarsal joints after the first nursing week (%)

Trait	Type A (10 %)	Type B (40 %)	Type C (10 % + 40 %)	P
Number of piglets (n)	1,031	1,117	1,215	
Left carpal joint	35.3 a	56.0 b	41.0 c	0.000
Right carpal joint	35.1 a	55.5 b	39.9 a	0.000
Left tarsal joint	93.6	95.8	95.3	0.051
Right tarsal joint	94.1	95.6	95.2	0.231

Table 3

Impact of floor type on sow activity and resting behaviour two weeks after farrowing

Trait	Type A Mean	s.d.	Type B Mean	s.d.	Type C Mean	s.d.	P*
Number of sows	21		24		31		
Duration (% of obersvation time)							
Lying (all together)[1]	80.9	7.4	85.2	7.8	85.9	6.6	0.043
Lying on the belly	38.3 b	13.9	27.0 a	16.0	37.9 b	12.9	0.009
Sitting	4.3 b	3.1	1.8 a	1.4	2.0 a	1.4	0.002
Standing	14.8	5.2	13.0	7.1	12.1	6.1	0.149
Frequency							
Lying (all together)[1]	29.8 b	14.2	17.5 a	5.7	26.0 b	12.2	0.001
Lying on the belly	30.5 b	11.8	18.0 a	6.6	28.7 b	9.8	0.000
Sitting	26.5 b	15.5	13.2 a	6.3	22.4 b	12.0	0.005
Standing	11.6 b	3.3	8.8 a	2.9	8.6 a	3.7	0.000
All positions[2]	83.6 b	28.3	53.6 a	15.3	77.9 b	27.2	0.000
Duration per action (seconds)							
Lying (all together)[1]	1,355 b	1,123	2,086 a	1,274	1,717 b	1,597	0.001
Lying on the belly	494	254	527	221	512	209	0.611
Sitting	59 b	38	44 ab	25	33 a	20	0.004
Standing	487	203	563	326	555	277	0.811

* Kruskall-Wallis-Test

[abc] within rows, means that do not have a common superscript differ ($p<0.05$; Mann-Whitney-U-Test)

[1] all lying actions disrupted by standing or sitting, no matter if the lying position during the lying action was changed or not

[2] sum of sitting, standing and all lying positions

Conclusions

The present study shows that technical details such as floor material, construction or arrangement of the slats (parallel or diagonal to the longitudinal axis of the sow) can have a greater influence on the welfare of pigs than the degree of perforation itself. Therefore, the degree of floor perforation per se does only provide limited information for the welfare assessment of housing systems.

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